September 29, 2011

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

In the Matter of	)	
AP1000 Design Certification Amendment	)	NRC-2010-0131
10 CFR Part 52	)	RIN 3150-A181

SUPPLEMENTAL COMMENTS BY THE AP1000 OVERSIGHT GROUP ET AL.
REGARDING FAILURE OF RULEMAKING ON CERTIFICATION

NOW COME the AP1000 Oversight Group, the North Carolina Waste Awareness and Reduction Network (NC WARN) and Friends of the Earth (collectively the "Oversight Group") with supplements comments regarding the failure of the rulemaking on the certification of the AP1000 reactor design and operating procedures, Docket NRC-2010-0131, and raising the issue of thermal loading in the rulemaking record.

In its Memorandum and Order, CLI-11-05, September 9, 2011, the Commission addressed the Oversight Group's concerns by referring its comments and petitions to the Staff to be resolved in the Rulemaking Docket, NRC-2010-0131. In its Order the Commission ruled that

> [we] *Refer* to the NRC Staff those elements of the Petition that relate specifically to design certification, for consideration as rulemaking comments. *Refer* to the NRC Staff for resolution as comments in the AP1000 rulemaking proceeding, all additional filings relevant to the AP1000 rulemaking proceeding.

The Oversight Group has diligently submitted comments into the rulemaking record as issues affecting the safety and reliability of the AP1000 reactors. In addition to other comments in the rulemaking record, we urge the Commission and the NRC Staff to review the following:

- On April 6, 2011, the Oversight Group filed its Petition to Suspend AP1000 Design Certification Rulemaking Pending Evaluation of Fukushima Accident Implications on Design and Operational Procedures and Request for Expedited Consideration.
- On April 20, 2011, the Oversight Group filed additional comments in conjunction with the Emergency Petition regarding the Fukushima lessons learned filed in the various licensing and rulemaking dockets. On May 9, 2011, the Oversight Group filed a reply to the NRC and industry responses to the Emergency Petition.
- On May 10, 2011, the Oversight Group filed comments that included reports by Union of Concerned Scientists, "Safer Storage of Spent Nuclear Fuel: The Problems of Spent Fuel Pools"; the statement of David Lochbaum, Union of Concerned Scientists, to the U.S. Senate Energy and Natural Resources Committee; Alvarez et al., "Reducing the Hazardous from Stored Spent Power-Reactor Fuel in the United States"; Thompson, "Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security"; and National Academies of Science, "Safety and Security of Commercial Spent Nuclear Storage (Public Report)."
- On May 10, 2011, Friends of the Earth filed comments on behalf of itself and Fairewinds Associates.
- On May 24, 2011, the Oversight Group filed additional comments the Markey report, Chairman Jaczko's Statement on Fukushima of May 20, 2011 and news reports on the Fukushima accident.
- On June 16, 2011, the Oversight Group filed a Request to Reexamine the Rulemaking on Certification of AP1000 Reactors and Declare it Null and Void based on unresolved problems with the AP1000 design and operations, the Ma Nonconcurrence (redacted version), the changes in Revision 19 and the

Fukushima "lessons learned."

- On August 11, 2011, the Oversight Group filed Supplemental Comments by the Ap1000 Oversight Group et al. Regarding NEPA Requirement to Address Safety and Environmental Implications of the Fukushima Task Force Report, supported by a declaration of Arjun Makhijani, Institute for Energy and Environmental Research.

These earlier comments and petitions were submitted in the rulemaking docket and with the Commission, and are adopted herein by reference.

I. INTRODUCTION AND SUMMARY.

The Oversight Group provides the supplemental comments herein to describe the failure of the rulemaking process for the certification of the AP1000 reactor.[1] Initially the NRC expected the final design would be certified prior to the final reviews of the combined operating licenses (COLAs). See *Backgrounder on New Nuclear Plant Designs*.[2] This has not occurred as the certification process has become bogged down by design changes, unresolved issues and rapidly escalating costs to meet even basic safety considerations. The process has been excessively, even arbitrarily, fluid as Westinghouse-Toshiba has submitted various revisions to the Design Control Document (DCD) for the AP1000 reactor over the past five years and as noted in our earlier filings in this docket, still has not begun to address the Fukushima "lessons learned" in any meaningful way. The NRC staff review and review by the Advisory Committee on Reactor Safeguards (ACRS) have not been able to address critical issues in a timely manner, especially as Westinghouse-Toshiba has changed the design and operating procedures repeatedly over the past five years.

[1] Additional information on the AP1000 DCD is available at www.nrc.gov/reactors/new-reactors/design-cert/amended-ap1000.html

[2] www.nrc.gov/reading-rm/doc-collections/fact-sheets/new-nuc-plant-des-bg.html

On January 27, 2006, the Commission issued the final design certification rule AP1000 design, DCD Revision 15, in the Federal Register, 71 FR 4464, and adopted the rule on March 10, 2006. .Applicants or licensees intending to construct and operate a plant based on the AP1000 design could do so by referencing the rule as set forth in 10 CFR Part 52, Appendix D. However, on May 26, 2007, Westinghouse-Toshiba submitted a Revision 16 of the AP1000 DCD; on September 22, 2008, Westinghouse-Toshiba updated its application with Revision 17; on October 14, 2008, Westinghouse-Toshiba provided the DCD Revision 17; on December 1, 2010, Westinghouse-Toshiba submitted DCD Revision 18; and on June 13, 2011, Westinghouse-Toshiba submitted DCD Revision 19. It is important to note the current certification rulemaking in Docket NRC-2010-0131 is on the AP1000 Revision 18 but subsequent to the end of the comment period on the rulemaking, May 10, 2011, Westinghouse-Toshiba submitted Revision 19 containing 100's of substantive changes to Tier 1 and Tier 2 components from Revision 18. ATTACHED. The Revision 19 changes have not been part of the certification rulemaking process to date.

Not only has the certification process constantly changed, recent actions to accelerate the certification process have called into question the ultimate results of the process. Pressure has apparently increased in order to certify the AP1000 reactors so combined operating licenses ("COLs") can be issued. In an August 5, 2011, letter from the NRC's Office of New Reactors to Westinghouse-Toshiba, the NRC said that "the final rulemaking package [for the AP1000] is in preparation, and is expected to be provided to the Commission for their deliberation no later than October 5, 2011, and the projected time frame for publication of the final rule in the Federal Register is January 2012." The NRC staff response to public comments apparently will not be provided to the public prior to the Commission decision. The NRC staff even requested the ACRS to waive its authority to sign off on the latest DCD revision so that the Commission could certify the design. As noted above, on May 10, 2011, Westinghouse-Toshiba filed

Revision 19, and yet only 85 days later, on August 5, 2011, the NRC issued a Final Safety Evaluation Report (FSER) which purported to address the Revision 19 changes.[3] Expediting the process near its end – and at the same time ignoring safety concerns – shows the failure of the certification process to date. The Oversight Group contends that public health and safety necessitate that all problems must be addressed before the reactor is "certified" by the NRC and not during construction.

On September 19, 2011, the ACRS sent a letter to Chairman Jaczko signing off on the AP1000 reactors yet at the same time discussed concerns related to the shield building, the passive cooling system tank, seismic and thermal load combination, radiative effects on thermal loads (see discussion below), inclusion of design details in the DCD, the containment accident pressure analysis, radiative effects on containment evaluation model validation and the reactor coolant pump testing.[4] These issues, and other changes between DCD Revisions 18 and 19, have not been subject to a rulemaking process and the Commission cannot certify the AP1000 design and operating procedures without availing the public with the opportunity to comment on Revision 19.

As demonstrated by the comments and petitions by the Oversight Group, the Fukushima accident requires a further reexamination of the AP1000 reactor design and operating procedures. As a result, the Oversight Group fully expects a DCD Revision 20 containing significant changes required from the Fukushima lessons learned to be forthcoming. As described in Lyman, *Surviving the One-Two Nuclear Punch: Assessing Risk and Policy in a Post-Fukushima World*, Union of Concerned Scientists, September 19, 2011, the AP1000 design would not have been an advantage in a Fukushima-type

[3] FSER Related to Certification of the AP1000 Standard Plant Design, Docket No. 52-006, NUREG-1793 Supplement 2, August 5, 2011. ADAMS No. ML112061231.

[4] ACRS, Revision 19 to the AP1000 Design Control Document and the AP1000 Final Safety Evaluation Report, September 19, 2011. ADAMS No. ML11256A180.

scenario. ATTACHED. Directly contrary to the long-standing process of certified design before issuance of the COL, the process suggested in the NRC Task Force Report, *Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, July 12, 2011 pushes the Fukushima lessons learned into the COL stage rather than resolved at the certification stage; each reactor then becomes a prototype as case-by-case review of potential design and operational changes are made after construction begins. The legal and policy question is whether changes stemming from the NRC review process of the Fukushima accident will occur after any of the reactors planning to utilize the AP1000 design receives its combined operating license.[5]

As demonstrated in the earlier comments and petitions by the Oversight Group, the safety issues related to the DCD Revision 18 and the earlier versions were glossed over. As an example, one of the ACRS's fundamental concerns about Revision 18 was the possibility of debris clogging up the "passive" water circulation system. Westinghouse-Toshiba relies on its claim that operators could "walk away" from an AP1000 accident due to its passive emergency cooling systems. This claim is seriously flawed as an earthquake, attack or loss of coolant accident could destroy those systems, including the water tanks on top of the reactor, and as the Fukushima accident demonstrated, debris could include the entire supporting structures and even the water tanks themselves, rendering the passive system inoperable. See Lyman, *supra*, p. 52.

In its comments and petitions, the Oversight Group presented several unresolved

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[5] The primary reactor applications being actively pursued using the AP1000 reactors are Plant Vogtle in Georgia, and the V.C. Summer reactor in South Carolina. Even without certification of the reactor design or licensing approval for the specific project, the companies are now being allowed to assemble the reactors' containments. Because of the nuclear financing laws in those states and the United States taxpayer loan guarantee for the Vogtle reactor, these reactors put federal taxpayers and state electricity customers at risk of massive cost overruns and project abandonment. The subsequent structural changes expected from Fukushima lessons learned will compound the cost factors.

issues with the DCD Revision 18, some of which were structural problems with the AP1000 design and others related to the Fukushima reactor:

- the fundamental design flaw with the AP1000 design, by which radioactive steam in some scenarios is vented directly into the environment through cracks and through holes in the containment structures.
- the brittleness of the concrete containment structures, as evidenced in the Nonconcurrence of Dr. John Ma.
- the inability of the shield building to withstand external forces, ranging from tornadoes and earthquakes to airplane crashes and terrorist attacks.
- the vulnerability of spent fuel pools, amplified by high density racking
- the lack of adequate emergency planning.
- the lack of consideration of severe accidents, i.e., beyond design basis accidents.

These issues were not resolved in the lately-filed DCD Revision 19, and the cursory review of that revision by the NRC staff demonstrates the failure of the certification process to date.

II. New Issue – Thermal Loading.

The shield building design is flawed as thermal loading has not been properly analyzed by Westinghouse-Toshiba or the NRC staff as part of its containment accident pressure analysis. One of the significant changes between DCD Revisions 18 and 19 stemmed from the result of the NRC staff requirement that Westinghouse-Toshiba recalculate pressure in the containment structures. Westinghouse-Toshiba has kept these calculations proprietary so the Oversight Group does not know the assumptions going into the calculations, although assumptions both increasing and decreasing the calculated pressure were made in DCD Revision 19.[6] The conclusion of the

[6] See also ACRS discussion in its letter of September 19, 2011, referenced in footnote 4 above.

Westinghouse-Toshiba calculations was that the pressure in the containment fell barely below the maximum design pressure limit of 59 psig, resulting in little margin for error. It is apparent that modeling assumptions, such as finding that metal grates were “new heat sinks,” were changed over several computer runs to come in under the wire.

The issue of radiative effects on thermal loads was presented to the ACRS by Dr. Susan Sterrett at the ACRS subcommittee meeting of August 16, 2011 and the ACRS meeting of September 8, 2011, and in comments to the ACRS. ATTACHED, Transcript to the September 8, 2011 meeting of the ACRS, pp. 251-269, 490-512. At the ACRS meeting, Dr. Sterrett, a former design engineer for Westinghouse-Toshiba, indicated that the pressure calculations in DCD Revision 19 appear to disregard a significant component to the integrity of the shield building, i.e., thermal changes caused by solar heating and nighttime cooling. This is crucial because the AP1000 reactors have only been referenced by the utilities in the Southeastern states, where both daily and seasonal heat differentials are a reality. Dr. Sterrett demonstrated that the heat loading of the shield building could result in weakness and failure under external stresses, such as an earthquake, and could cause the reactor containment to exceed maximum design pressure during various accident conditions. Loss of the shield building or damage to it could mean loss of the water tank on top of the structure and thus loss of the key passive cooling feature. She noted that this summer, solar heating caused concrete to buckle at airports and bridges, and water pipes across the US to burst open, but that the NRC is ignoring this "simple matter of basic physics" in its review of the nuclear plant design.

Dr. Sterrett maintained that heat transfer to and from the reactor building is a very important factor in the safety analysis of this plant involving many calculations. The major omission of ignoring solar heating in the calculations has serious material consequences. First, solar heating is important to the structural integrity of the shield building, which supports the 7 – 10 million pound water tank for the passive containment

cooling system. Dr. Sterrett's stated the "testing for emergency cooling of the reactor containment was performed in a way that tends to overestimate the ability for water sprayed from the overhead tank to cool the containment dome, thus leading to the underestimation of peak pressure within the dome during an accident." She concluded that "both are important for predicting the heat removal capability of the passive containment cooling system to remove decay heat after an accident ACRS. It is more crucial on keeping the containment cooled in this passive design than on other operating plants, which have double-walled containments and powerful pumps to drive emergency cooling.

On pp. 3 and 4 of its letter of September 19, 2011[7], the ACRS evaded fundamental issues concerning the radiative effects on thermal loads by first stating the most limiting case was the winter ambient temperature differences, but then "resolving" the issue by addressing the maximum summer surface temperatures. The ACRS simply does NOT address the radiative heat transfer for the case that it, and Westinghouse-Toshiba, maintain has the most impact. Nor does the ACRS resolve the issues of temperature differentials over time and the stresses those place on the shield building. It appears that from the graph provided by Westinghouse-Toshiba to the ACRS, the ACRS did not examine the effect of radiative heating over more than the course of a single day. This is significant for two reasons: first, the concrete failures in other concrete structures occurred only after many days of sunny hot weather, and, second, there can be cumulative temperature increases over the course of an extended period of hot sunny weather, such as the 2011 heat waves experienced throughout the southeastern US in 2011. Looking only at the solar gain over the course of one day does not provide sufficient information.

The ACRS letter relied upon an estimate from an unidentified ASHRAE table rather than the higher temperatures concrete surfaces have actually reached in various

[7] Referenced in footnote 6 above.

parts of the United States this past summer. The ACRS does not provide any basis for relying solely on the estimate table rather than on using methodologies to calculate temperatures developed by other Federal agencies and cited in Dr. Sterrett's comments, such as the Oak Ridge Laboratory and the National Institute of Standards and Technology, for comparison. The Oversight Group suggests that the ACRS checks whether the ASHRAE table correctly predicts the much higher temperatures on the concrete surfaces that failed this past summer. These temperature differences becomes critical in assessing the integrity of the shield building over its operating life.

The corollary issue raised by Dr. Sterrett and not addressed by the ACRS is the differential thermal expansion of steel as compared to concrete in the concrete-filled steel panels. At page 186 of the transcript of the September 8, 2011, ACRS meeting[8], Westinghouse-Toshiba indicates that the only consideration it checked regarding differential thermal expansion was the differential temperature through the wall, not the much more problematic question of the differential thermal expansion of the steel with respect to the concrete in the SC panels:

> And we'd look at both the winter condition and the summer condition. And you will see here -- this slide is showing that the winter -- the delta T across the structure, across the wall, for the winter condition is the most limiting. And it is 110 degrees across the structure, degrees on the inside of the 18 shield building and minus 40 degrees on the outside. For the summer case, we look at the delta T as 45 degrees out and 70 degrees inside and 115 outside. And so you see our limiting case is the winter condition.

Differential expansion for steel and concrete was suspected as the cause of buckling of concrete bridges with steel joints or connections, and cannot be discounted.

The assumptions used by Westinghouse-Toshiba in calculating containment pressures and radiative effects, a fundamental part of the DCD Revision 19, have not been available for public review and comment. The cursory review by the NRC staff

[8] ADAMS No. ML11256A117

and the ACRS is deficient, and as a result, the Oversight Group recommends outside expertise to analyze the thermal loading issue.

III. CONCLUSION.

For the foregoing reasons, the comments of the Oversight Group should be considered in the Commission's deliberations on the necessity of initiating a rulemaking on Revision 19 and then another on the lessons learned from Fukushima (DCD Revision 20?) in order to lawfully certify the AP1000 reactor design and operating procedures. These comments supplement the earlier comments and petitions the Oversight Group and others have filed in this docket, and demonstrate that the present certification process is a failure and the AP1000 design should not be certified.

Respectfully submitted this 29th day of September 2011.

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ATTACHMENTS

1. Westinghouse AP1000 Design Control Document Rev. 19, ADAMS No. ML11157A500.

2. Lyman, *Surviving the One-Two Nuclear Punch: Assessing Risk and Policy in a Post-Fukushima World*, Union of Concerned Scientists, September 19, 2011

3. Dr. Sterrett presentation, transcript to the September 8, 2011 meeting of the ACRS, pp. 251-269.

4. Dr. Sterrett comments, transcript to the September 8, 2011 meeting of the ACRS, pp. 490-512